REPORT

TO THE

SELECTMEN OF BROOKLINE

CONCERNING

A SYSTEM OF SEWERAGE.

1875.

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VOTE OF THE TOWN.

At a meeting of the inhabitants of the Town of Brookline, held upon the twenty-second day of April, 1874, it was voted, —

"That the thirteenth article of the warrant be referred to the selectmen with instructions to investigate, by public hearings or otherwise, some plan by which a main drain or common sewer may be laid out and located, to provide an outlet for the sewage matter at the terminus of the present sewer, at Park and Harvard Streets. Also to see if a system of sewerage may not be established without contaminating the natural watercourses in the town, and that the selectmen be instructed to employ three engineers, two of whom shall not be residents of the town," &c. Vote of Town.

REPORT.

BOSTON, January, 1875.

TO THE SELECTMEN OF BROOKLINE.

Gentlemen, — Having been requested by you, in accordance with the vote of your town, above quoted, to examine and report upon the subjects therein named, we have duly considered the same.

Feasibility of an efficient system of sewerage at moderate cost.

An examination of the ground, together with the results of previous surveys, satisfies us that it is perfectly practicable to establish a very efficient system of sewerage, and at a comparatively moderate expense, for all that portion of the town likely to need it for the next twenty years.

Ultimate disposal of sewage.

In considering such a subject as that of town drainage, the first and most important question with reference to any particular place is, what disposition shall be made of the ordinary discharges from the sewers, or of the *sewage*, a term which we shall use in this sense hereafter.

Problem unsolved.

We are here met by a problem that has exercised many of the ablest minds of the scientific world for more than twenty years past, without being satisfactorily solved.

Up to this day we know of no large city or town in the world which has been able to dispose of its sewage in such a way as to avoid a nuisance, except where it is situated on a large running stream or body of deep water agitated by winds and waves. Even then, in the latter case, the nuisance often returns to plague those who make it.

We do not deem it essential or desirable to encumber this report with a description of the various processes that have been tried for utilizing or disposing of sewage. Volumes

have been written on the subject, and volumes more are likely to be, before the question is finally settled. We have endeavored to keep thoroughly informed upon this matter, and have watched with much interest every new process, and carefully read the published results of the experiences of those cities, towns, and institutions that have tried the irrigating, the deodorizing, the dry earth and other systems. Whatever success may have attended any of these devices in limited districts and favorable localities, we are satisfied that none of them but that which is known as the *water-carriage* system, unaccompanied by deodorizing or irrigation works, can be safely attempted at present in Brookline. By this system we mean ordinary sewers that will take the discharge from water closets, kitchen sinks, manufactories, &c., without stoppage, to the nearest natural receptacle where it will create the least possible nuisance.

Water carriage safest.

Main sewer recommended.

With these views, and after a careful consideration of the subject, we recommend, as a base for the system of sewerage of Brookline, a main intercepting sewer along, or near, the left bank of "Muddy Brook," to the vicinity of St. Mary's Street, and along this street to the channel of Charles River. The exact location of this sewer is given in an appendix at the end of this report, together with a description of the principal branches, overflows, &c., and an estimate of their cost.

Objections to outfall in Charles River.

We are well aware of the objections that can be urged against the discharge of any more sewage into Charles River, and would by no means underrate them. The growing complaints concerning the marshes and flats exposed at low water around Boston, and the increasing anxiety on the subject in the minds of those charged with the sanitary condition of the City and State, are evidences of the vital importance of this question. We would, therefore, at the outset, give our reasons for what may appear to some to be a disregard of the views deemed of importance by others.

Question is limited to such action as can now be taken.

The question to be considered is not, in our minds, what would be a *faultless* system of sewerage for Brookline, both in its construction and effects, for this we look upon at present as unattainable; but the question is, what system is, on the whole the most *advisable*, in the existing state of

knowledge on the subject. To say that nothing shall be done, is to say that population shall cease to grow, and that no further improvements shall be made, which is not desirable, or that the evils of past systems shall disappear without effort, which is not possible.

Some action is imperative.

The elements of growth and prosperity which already exist, and which are sure to increase, necessarily require increasing means for the removal of filth, as well as the drainage of buildings, including, as far as possible, their foundations. To effect this, we can point with safety and assurance to no system but the one herein recommended, for we know of no other that has been successfully carried out, even in small towns, in this country or any other, having a climate as rigorous as ours.

Only one course open to us now.

Whatever may be found best in the future with regard to the treatment of fœcal and kitchen refuse and other concentrated elements of sewage, we cannot conceive of the sewers now recommended ceasing to be worth their cost. The liquid elements at least must be collected, and these sewers would be placed as nearly as practicable where the natural features of the territory to be drained require them. Rains will fall in their season: these must be removed from the streets and other improved surfaces of the ground; cellars and foundations of buildings must be drained. It would be miraculous if it should ever cease to be necessary to discharge into the sewers large bodies of water from laundries, from bath-tubs, and from various manufacturing establishments, all of which should be kept out of the small, natural, open channels of brooks and valleys, but which would not necessarily contaminate a stream as large as Charles River at tide water. Moreover, if the whole sewage is to be utilized in the future, it must first be *collected*, which the system now proposed would satisfactorily do.

Works now recommended will be of use in any event.

The location of the main intercepting sewer having been determined by the natural requirements of the district to be drained, and by the limits of the jurisdiction of the town, the height of the outfall with reference to low water in the harbor, the inclination and sizes of the sewer become matters of considerable importance.

With regard to the height of the outfall, two important

Height of outfall in relation to tides.

reasons exist for keeping it as high as possible; viz., to prevent the influx of tide-water at the mouth, and to afford an advantageous connection with any intercepting sewer which may hereafter be constructed on the south side of Charles River for Boston and vicinity. On the other hand, it is extremely desirable to keep the outlet as *low* as possible, both to secure an efficient inclination to the sewer, and to drain as well as may be the low-lying district along the left bank of Muddy Brook, especially in the vicinity of the Brookline Railroad Station. We therefore recommend that the bottom of the outfall be placed at the level of half-tide, and that a self-acting tide-gate be placed there.

Why kept high.

Why kept low.

Half-tide recommended.

Should a grand scheme ever be carried out for marginal intercepting sewers for Boston, it is probable that resort must be had to pumping to make such a scheme efficient, in which case the low level above named for the outfall of the Brookline sewer will not be found objectionable.

Inclination and size.

With regard to the inclination and sizes of the main sewer. They must be determined, not only by the considerations above mentioned, but by the quantity of rain-fall it may be thought best to provide for. Owing to the very favorable topography of Brookline in this respect, it is practicable to construct sewers to carry off any desirable proportion of the rain-fall. It is not thought best to limit the size of this or any other sewer, to carry off just the ordinary dry weather sewage, but to receive a rain-fall of one tenth of an inch an hour from the surfaces drained by them. The full carrying capacity of the sewers, would not, probably, be reached without a continuous rain at the rate of half an inch per hour, and would rarely be exceeded in violent storms. The sewage alone would never amount to over about four per cent of their whole capacity. The rain-water admitted would give the sewers such occasional scouring as to render them practically what are called "self-cleansing." In case of heavy rain-falls, the surplus which these sewers could not carry off could be easily discharged at various points into the natural brook channels by means of waste weirs, as will be mentioned more particularly below.

Amount of rain-water to be removed is subject to option.

Surplus storm water overflows.

Sizes and forms.

The general characteristics of the parts of Brookline to be drained, admit of adopting the most economical sizes, and

the most advantageous forms of sewers. The grades of the streets afford ample inclinations, and the frequent opportunities for discharging surplus rain-water into natural channels render it unnecessary to provide branch sewers of over forty-four inches diameter anywhere. The oval form, when skilfully constructed, in such a locality as yours, and with the small amount of sewage likely to be carried, would be somewhat easier to keep clean than the circular, though neither would probably give serious trouble. For all sewers of two feet diameter and upwards, we would recommend brick, laid in hydraulic cement. For all of fifteen inches diameter and under, we would recommend hard burned clay pipes. These are very easy to keep clean and very efficient. A fifteen inch hard burnt clay pipe sewer would probably cost as much as a two feet brick one, and as a small man can go through the latter, it is not advisable to construct brick sewers smaller than this. The advantage of being able to send a man through a sewer is not confined to sewerage purposes, but applies to the discovery and prevention of the waste of water, a matter in which the town will become more and more interested hereafter.

Materials.

The need of flushing the sewers beyond the scouring which rains would give is not likely to occur often; but should it do so, the water-supply of the town, and the natural watercourses, would make this both practicable and economical. Actual experience alone could determine what parts of the sewers would need such treatment.

Flushing.

The sewers already constructed by the town should be used as far as practicable; and this can be done throughout their whole extent nearly, either for direct connection with the houses, or to carry off surface water.

Old sewers to be utilized.

As population increases, it will be necessary to extend the sewerage system. This should be considered, when laying out new streets. In such cases, it often becomes desirable to modify or control the position of a new street, that it may be made available for drainage purposes. In a few cases, it may be necessary to obtain the right of way for sewers alone; and this, as far as can be foreseen, had better be done soon to avoid enormous costs hereafter. For similar reasons, it is recommended that the grades of certain streets be raised,

Systems must be extended gradually.

Right of way.

Change of grade in streets.

which are now too low, for short distances, to allow proper covering above the sewers.

Pollution of Muddy Brook from Boston sewage.

The flow of sewage from the outfall of some of the Boston sewers, brought by the flood-tides up Muddy Brook, has already been a source of complaint, which will be likely to increase. The only efficient remedy we can think of, is to fill up the flats and wide channels to the level of high water, leaving open sufficient channels for the brook, which should be walled in on both sides, as has already been done to some extent by your town, in the rear of the gas-works.

Natural channels to be kept pure.

When once a sewerage system is carried out, all further pollution of the natural watercourses should be strictly forbidden, whether such pollution come from privies, water-closets, sink drains, stables, or other similar sources.

Private drains.

The best system of drainage that could be devised would be of comparatively little benefit, unless the houses were carefully connected with the sewers. This should be done under proper regulations, by licensed drain-layers, placed under bonds to do their work well. Much trouble is caused to many citizens elsewhere, by the unskilful and unfaithful work of drain-layers.

Ventilation.

Owing to various causes, foul air will frequently collect in sewers; and under certain circumstances find its way into the houses. To prevent this, as far as possible, it is necessary, not only to have faithful workmanship on the part of the drain-layers, but every advantage should be taken of local and natural circumstances, to give vent to the foul air. Water-spouts from roofs, and, better yet, such chimneys as are always heated, afford excellent means for this end. Plumbers should be required to assist in the ventilation of sewers and private drains, by giving vent in such places as may be devised, where not likely to be again mixed with the air to be breathed.

Districts not now provided for.

Should portions of the town not provided for by the plan now presented, be so improved within a few years as to require sewerage, it would be quite practicable to meet such wants by means of high level intercepting sewers discharging into Charles River above St. Mary's Street, or by following the natural drainage, sometimes through or into parts of Boston. The surface of the ground would readily admit of

carrying out such schemes; but as it is impossible to foretell where new streets will be laid out hereafter, it is impossible to say where it would be best to construct such sewers. Besides, it is not thought advisable to provide for such large areas long before they are likely to be built upon to any extent. The cost would be great, and the saving of interest on such additional expenditures, would, no doubt, more than suffice for the construction of works, whenever they may be required.

Respectfully submitted,

E. S. Chesbrough,
W. H. Bradley,
Edward S. Philbrick.

APPENDIX.

Description of location of the principal sewers which are recommended.

Main sewer.

The whole area which it appears best to provide for at present by the main sewer is about a thousand acres, being a district bounded as follows; viz., On the southeast by Pond Avenue and Brookline Avenue, as far as the corner of Pearl and Emerald Streets. Thence along the Brookline Branch Railroad to Chapel Station; thence by St. Mary's Street to Charles River. On the northeast by the Boston line, as far as the corner of Pleasant Street and Brighton Avenue, excepting the low lands between Essex Street and Forth Street, which seem to demand a separate outlet to the river. On the north by the water-shed of the brook which forms the Brighton line, being a line running from the top of the hill on Brighton Avenue, near the corner of Pleasant Street, westerly, across Babcock Steeet, and across Harvard Street and Winchester Street, on the old Coolidge Farm, to the crest of Corey's Hill. Westerly by a line beginning where Washington Street crosses the Brighton line, and passing southerly to the corner of Beacon and Tappan Streets. Thence following Tappan Street, to a point near Mr. D. H. Roger's house. Thence across to the top of Bradley's hill and Mrs. Bowditch's house near the first parish church. Thence southerly to the town line near Mrs. Cleveland's house, and along the town line to the place of beginning on Pond Avenue. To accommodate the drainage of this territory, we would recommend the main sewer, at its outlet, to be of a size equivalent to a circle of six feet diameter, and that it be constructed of this size, and with an inclination of one foot in a thousand, up St. Mary's Street to Beacon, and up Beacon to Carlton Street, where the first large branch would come in from the western part of Beacon Street. The

Size of main and inclination.

Course of main.

main sewer would then follow through Carlton Street and Colchester Street, to a point near the south end of Hawes Street. Above Beacon Street the size of the main may be reduced to five and a half feet in diameter. With the same inclination as before, it should follow along the northerly side of the railroad, passing under Longwood Avenue, and just north of the station, still along the railroad to Aspinwall Avenue, where another large branch would connect. The size of the main can here be reduced to three feet diameter, and the inclination increased to one foot and a third in a thousand, to a point opposite the southwest side of Linden Place produced, where the main would cross under the railroad, and over the walled brook channel to the north-east corner of Pearl Street and Emerald Street. The main would then proceed through Pearl Street, crossing over the other brook channel and into Washington Street. It would cross this street nearly opposite the old Lyceum Hall, where it would pass under the Cochituate water mains, and receive the sewage of Boylston and Walnut Streets, through the old sewers already constructed. This would probably be as far as the construction would be called for at present. Whenever so needed, this main can be extended, with diminished capacity, through such new streets as may be hereafter laid out, to intersect Pond Avenue near the Ward schoolhouse, and thence through the whole length of the western part of Pond Avenue to Chestnut Street, which, with Sewall Place, would here find efficient drainage. A portion of Pond Avenue would probably need to be raised some three or four feet, unless a smaller rate of inclination than two per thousand were given to this sewer, with a corresponding size. As it is not intended that this main should take all the storm water from the streets through to the river, waste weirs for the overflow of such water in violent rains should be provided at the various points where found most convenient or desirable to discharge this surplus into the natural watercourses. Such points are found along Chestnut Street and Pond Avenue, also where crossing the walled channels in Pearl Street, and at various points where crossing or approaching the natural channels which would pass beneath the main sewer along the north side of the Brookline Branch Railroad.

Branch at Beacon Street.

The first large tributary above referred to joins the main at the corner of Beacon and Carlton Streets. This branch would continue up Beacon Street, across Harvard Street, to the top of the hill near the estate of Otis Withington, and would receive several minor branches from the north, at intersections of other streets, draining all that section of the town lying north of Beacon Street, up to the water-shed of "Smelt brook," except the small area above referred to, lying been Essex and Forth Streets. On the south side of Beacon Street, this sewer would drain Kent Street up to the corner of Dudley Street, also St. Paul Street, as far as Longwood Avenue. An overflow for storm water should be provided near St. Paul Street or Borland Street; east of St. Paul Street, its diameter should be three feet. West of St. Paul Street the drainage area is so far reduced as to largely cut down the probable flow, while the inclination is increased, so that a diameter of two feet will suffice up to Harvard Street. There is said to be a brick sewer already laid for a part, if not for the whole, of this distance, but no record of its size, location, or level can be found at the office of the town engineer.

Beyond Harvard Street the drainage of this district can be carried by pipes.

Small branches.

Small branches would enter the main sewer as follows: Mountfort Street would drain directly to St. Mary's Street, Essex and Prescott Streets would drain through Ivy Street to St. Mary's. Small branches would also enter the main from Monmouth, Hawes and Colchester Streets.

Longwood Avenue branch.

The Longwood Avenue branch would be a small one, unless it be thought best to make a deep cut near the west end of Kent Street, to drain the whole length of Longwood Avenue through to the main, directly. It may be preferable to provide for the drainage of this street through Toxteth Street, by laying out a new street in that direction, if the right of way for such a street can be had without too great a cost.

Aspinwall Avenue branch.

The branch entering the main sewer at Aspinwall Avenue would probably drain a district of five hundred and seventy acres, comprising the following streets and spaces; viz., bounded on the east and North by the Beacon Street drainage, unless Longwood Avenue be drained directly to

the main, it would drain Harvard Street from the corner of Pleasant Street south to Linden Place, with the short streets sloping towards it; nearly the whole of Park Street, Harvard Avenue, &c.; the whole of Washington Street from the Brighton line to the Public Library; Cypress Street from Walnut Street east; the whole of Tappan Street up to Mr. Bowditch's house; Boylston Street from Dr. Shurtleff's estate to the top of Bradley's hill, and eventually up to Brighton Street; also Walnut Street west of Mr. A. A. Cobb's estate. The storm water collected by this sewer should be provided with overflows as follows: At the railroad crossing in Cypress Street; at the corner of Washington and Beacon Streets near the tanneries; at the south end of Park Street; at the corner of School and Harvard Streets, and at the junction with the main.

The present brook channel, for four hundred feet east of Harvard Street, lies in a brick conduit, four feet and a half in diameter, which it is not proposed to disturb. Its office will be to carry the brook water as before, with such surplus storm water as may be thrown into it from the new sewers at the points of overflow. The new sewer would probably cross over the lower end of this conduit near Mr. Melcher's house, and it will probably be found expedient to raise the street two or three feet here, to afford the proper inclination to the sewer eastward from this point.

A portion of Harvard Street north of School Street, is already provided with a brick sewer about two feet in diameter, now discharging surface water into the brook at the corner of School Street. This sewer is probably sufficient for Harvard Street as far as it goes, and as it has a very rapid fall it may perhaps drain Harvard Avenue and Park Street, as well as the other short streets in that vicinity, also Harvard Street to Longwood Avenue when extended. Instead, however, of discharging into the brook as at present, it must be connected with the new sewer at the corner of Harvard and School Streets, by crossing under the brook at this point. Passing up School Street we find a brick sewer of two feet diameter already constructed, which, with its rapid fall, will probably be sufficient for the area to be drained above this point. The diameter of this sewer, from the main up to

Harvard Street, should be forty-four inches, and from Washington Street through Cypress Street to the Railroad, twenty-seven inches.

The old cement sewer now used for street water between the Railroad and Cypress Place, inclines westward, and therefore would not be connected with the new system; but as it already receives a considerable amount of street surface water, it would continue to answer a useful purpose by relieving the new system to this extent.

South of the Railroad crossing a brick sewer is already in use for street drainage as far as Walnut Street. This now discharges into the brook at the Railroad crossing, but should be taken up for a few rods south of its present outfall and carried over the brook at about the same level with the water pipe, having provision here for overflow.

The ramifications of this sewer can be applied as called for by the needs of the population. They will generally have a rapid fall, and west of Washington Street can generally be provided for by twelve-inch and fifteen-inch pipes.

Branch near the R.R. station.

Passing up the main sewer from Aspinwall Avenue along the Railroad track, the next branch will join it near the line of Linden Place produced. It will bring the sewage of Washington Street, from the town library to the Railroad Station, where a good sewer already exists, and that of Harvard Street south of Linden Place, also the contents of such other sewers as may be laid in the courts in that vicinity,

Davis Avenue.

and a part or the whole of Davis Avenue. It may be expedient to raise the grade of a portion of the latter street, to avoid crossing private property to drain the low portion in the middle of its length. The alternative would be to cross private property, to and through Whyte Place, to the Railroad Station.

This branch can pass along north of the Railroad Station and tracks, where it could probably be constructed without permanent damage to the Railroad Company, through whose lands it would pass. Of course an overflow should be provided for storm water into the brook channel near the station. In fact, the present outfall of the sewer in Washington Street can be adapted to this end. A diameter of two feet will be enough for this branch.

Following the main sewer across the Railroad and brook channels to Pearl Street, another small branch would join it in Pearl Street. This would drain Emerald Street, Brookline Avenue, and the lower end of Washington Street below the Horse Railroad stable. Its level in Pearl Street would be about fourteen feet above mean low water, so that it may become necessary to raise the grade of Brookline Avenue near the play ground, to afford sufficient covering for protection. In order to afford drainage to houses on the south-east side of Brookline Avenue and Washington street at this point, some peculiar means will probably be required to pass under the Cochituate water mains. Similar problems are solved in Boston by an inverted syphon.

Pearl Street branch.

Brookline Avenue, &c.

In connection with the branch just described it may be worth while to consider an alternative location for the main sewer in crossing the Railroad track some seven hundred feet farther west than above described, into the western corner of Pearl Street.

The choice between the two will be governed by local considerations. If this western point for crossing the Railroad be chosen, a small branch must still cross from Pearl Street into the main at the eastern point, to drain the lower end of Emerald Street and Brookline Avenue.

The first work to be done towards the construction of any part of this system should be the taking or purchasing of land for the main sewer along the Railroad, and filling the same over the marshes with good material. Time must be allowed for the consolidation of this filling, before proceeding with the construction.

TABLE SHOWING LENGTH, SIZE, AND PROBABLE COST OF PRINCIPAL SEWERS.

Location of Sewer.	Acres Drained.	Length in feet.	Inclination per 100 ft.	Diameter if circular.	Estimated Cost.
Main Sewer Gates and Outfall	1,000	.....	.....	.....	$2,400
Main Sewer Gate to Carlton Street	1,000	2,250	0.10	6′.0″	44,675
Main Sewer. Corner Beacon St. to Aspinwall Ave	750	4,075	0.10	5′.6″	40,525
Main Sewer. Aspinwall Ave. to Bend, towards Pearl St.	200	625	0.13	3′.0″	3,625
Main Sewer. Bend to Washington St	180	1,350	0.20	3′.0″	7,830
Total for Main to Washington St	.....	8,300	.....	.....	$99,055
Add for Land Damage	.....	.....	.....	.....	21,000
Beacon-St. Sewer from corner of Carlton to St. Paul St.	250	2,200	0.25	3′.0″	15,160
Aspinwall Ave. Sewer from R. R. Bridge to Harvard St.	570	2,250	0.38	3′.8″	21,600
Branch along Railroad to depot	40	1,200	0.13	2′.0″	3,900
					$160,715
Contingencies and Superintendence, 10 per cent	.....	.....	.....	.....	16,071
Total	.....	.....	.....	.....	$176,786